120.900: RADIATION SAFETY REQUIREMENTS FOR WIRELINE SERVICE OPERATIONS AND SUBSURFACE TRACER STUDIES

120.901: Purpose and Scope

105 CMR 120.900 establishes radiation safety requirements for persons using sources of radiation for wireline service operations including mineral logging, radioactive markers, and subsurface tracer studies. The requirements of 105 CMR 120.900 are in addition to, and not in substitution for, the requirements of 105 CMR 120.001, 120.020, 120.750, 120.100 and 120.200.

105 CMR 120.900 applies to all licensees or registrants who use sources of radiation for wireline service operations including mineral logging, radioactive markers, or subsurface tracer studies.

120.902: Definitions

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As used in 105 CMR 120.900, the following definitions apply:

Field Station, means a facility where radioactive sources may be stored or used and from which equipment is dispatched to temporary jobsites.

Injection Tool, means a device used for controlled subsurface injection of radioactive tracer material.

Logging Assistant, means the individual who, under the personal supervision of a logging supervisor, handles sealed sources or tracers that are not in logging tools or shipping containers or who performs surveys required by 105 CMR 120.951.

Logging Supervisor", means the individual who uses licensed material or provides personal supervision of the utilization of sources of radiation at the well site.

Logging Tool, means a device used subsurface to perform well-logging.

Mineral Logging, means any logging performed for the purpose of mineral exploration other than oil or gas.

Personal Supervision, means guidance and instruction by the supervisor who is physically present at the jobsite and watching the performance of the operation in such proximity that contact can be maintained and immediate assistance given as required.

Radioactive Marker, means radioactive material placed subsurface or on a structure intended for subsurface use for the purpose of depth determination or direction orientation.

Safety Review, means a periodic review provided by the licensee for its employees on radiation safety aspects of well logging. The review may include, as appropriate, the result of internal inspections, new procedures or equipment, accidents or errors that have been observed, and opportunities for employees to ask safety questions.

Source Holder, means a housing or assembly into which a radioactive source is placed for the purpose of facilitating the handling and use of the source in well-logging operations.

Subsurface Tracer Study, means the release of a substance tagged with radioactive material for the purpose of tracing the movement or position of the tagged substance in the well-bore or adjacent formation.

Surface Casing for Protecting Fresh Water Aquifers, means a pipe or tube used as a lining in a well to isolate fresh water aquifers from the well.

Temporary Jobsite, means a location to which radioactive materials have been dispatched to perform wireline service operations or subsurface tracer studies.

Uranium Sinker Bar, means a weight containing depleted uranium used to pull a logging tool toward the bottom of well.

Well-Bore, means a drilled hole in which wireline service operations and subsurface tracer studies are performed.

Well-Logging, means the lowering and raising of measuring devices or tools which may contain sources of radiation into well-bores or cavities for the purpose of obtaining information about the well and/or adjacent formations.

Wireline, means a cable containing one or more electrical conductors which is used to lower and raise logging tools in the well-bore.

Wireline Service Operation, means any evaluation or mechanical service which is performed in the well-bore using devices on a wireline.

120.903: Prohibition

No licensee shall perform wireline service operations with a sealed source(s) unless, prior to commencement of the operation, the licensee has a written agreement with the well operator, well owner, drilling contractor, or land owner that:

(A) (1) In the event a sealed source is lodged downhole, a reasonable effort at recovery will be made.

(2) A person may not attempt to recover a sealed source in a manner which, in the licensee's opinion, could result in its rupture.

(3) The licensee shall conduct radiation monitoring to detect any contamination.

(a) If the licensee detects evidence of that a sealed source has ruptured or licensed materials have caused contamination, the licensee shall initiate immediately the emergency procedures required in 105 CMR 120.932.

(b) If contamination results from the use of licensed material in well logging, the licensee shall decontaminate all work areas, equipment, and unrestricted areas.

(c) During efforts to recover a sealed source lodged in the well, the licensee shall continuously monitor, with an appropriate radiation detection instrument or a logging tool with a radiation detector, the circulating fluid from the well, if any, to check for contamination resulting from damage to the sealed source.

(4) If the environment, any equipment, or personnel are contaminated with licensed material, they must be decontaminated before release from the site or release for unrestricted use.

(B) In the event a decision is made to abandon the sealed source downhole, the requirements of 105 CMR 120.954(C) and any other Commonwealth Agency having applicable regulations shall be met.

(C) The licensee shall retain a copy of the written agreement for three years after the completion of the well logging operation.

120.911: Limits on Levels of Radiation

Sources of radiation shall be used, stored, and transported in such a manner that the transportation requirements of 105 CMR 120.100 and the dose limitation requirements of 105 CMR 120.200 are met.

120.912: Storage Precautions

(A) Each source of radiation, except accelerators, shall be provided with a storage and/or transport container. The container shall be provided with a lock, or tamper seal for calibration sources, to prevent unauthorized removal of, or exposure to, the source of radiation.

(B) Sources of radiation shall be stored in a manner which will minimize danger from explosion and/or fire.

120.913: Transport Precautions

Transport containers shall be physically secured to the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal.

120.914: Radiation Survey Instruments

(A) The licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments at each field station to make physical radiation surveys as required by 105 CMR 120.900 and 120.221. Instrumentation shall be capable of measuring 0.1 milliroentgen (2.58×10^{-8} C/kg) per hour through at least 50 milliroentgens (1.29×10^{-5} C/kg) per hour.

120.914: continued

(B) Each radiation survey instrument shall be calibrated:

(1) At intervals not to exceed six months and after each instrument servicing;

(2) For linear scale instruments, at two points located approximately **a** and **b** of full-scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at appropriate points; and,

(3) So that accuracy within plus or minus 20% of the true radiation level can be demonstrated on each scale.

(C) Calibration records shall be maintained for a period of three years for inspection by the Agency.

120.915: Leak Testing of Sealed Sources

(A) Requirements. Each licensee using sealed sources of radioactive material shall have the sources tested for leakage. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Agency for six months after the next required leak test is performed or until transfer or disposal of the sealed source.

(B) Method of Testing. Tests for leakage shall be performed only by persons specifically authorized to perform such tests by the Agency, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State. The test sample shall be taken from the surface of the source, source holder, or from the surface of the device in which the source is stored or mounted and on which one might expect contamination to accumulate. The test sample shall be analyzed for radioactive contamination, and the analysis shall be capable of detecting the presence of 0.005 microcurie (185 Bq) of radioactive material on the test sample.

(C) Interval of Testing. Each sealed source of radioactive material shall be tested at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made prior to the transfer, the sealed source shall not be put into use until tested. If, for any reason, it is suspected that a sealed source may be leaking, it shall be removed from service immediately and tested for leakage as soon as practical.

(D) Leaking or Contaminated Sources. If the test reveals the presence of 0.005 microcurie (185 Bq) or more of leakage or contamination, the licensee shall immediately withdraw the source from use and shall cause it to be decontaminated, repaired, or disposed of in accordance with 105 CMR 120.000. A report describing the equipment involved, the test results, and the corrective action taken shall be filed with the Agency within five working days.

(E) Exemptions. The following sources are exempted from the periodic leak test requirements of 105 CMR 120.915(A) through (D):

(1) Hydrogen-3 sources;

(2) Sources of radioactive material with a half-life of 30 days or less;

(3) Sealed sources of radioactive material in gaseous form;

(4) Sources of beta- and/or gamma-emitting radioactive material with an activity of 100 microcuries (3.7 MBq) or less; and,

(5) Sources of alpha-emitting radioactive material with an activity of ten microcuries (0.370 MBq) or less.

120.916: Quarterly Inventory

Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation. Records of inventories shall be maintained for three years from the date of the inventory for inspection by the Agency and shall include the quantities and kinds of sources of radiation, the location where sources of radiation are assigned, the date of the inventory, and the name of the individual conducting the inventory.

120.917: Utilization Records

Each licensee or registrant shall maintain current records, which shall be kept available for inspection by the Agency for three years from the date of the recorded event, showing the following information for each source of radiation:

(A) Make, model number, and a serial number or a description of each source of radiation used;

(B) The identity of the well-logging supervisor or field unit to whom assigned and the identity of the logging assistants present;

(C) Locations where used and dates of use; and,

(D) In the case of tracer materials and radioactive markers, the utilization record shall indicate the radionuclide and activity used in a particular well.

120.918: Design, Performance, and Certification Criteria for Sealed Sources Used in Downhole Operations

(A) Each sealed source, except those containing radioactive material in gaseous form, used in downhole operations and manufactured after the effective date of 105 CMR 120.000 shall be certified by the manufacturer, or other testing organization acceptable to the Agency, to meet the following minimum criteria:

(1) Be of doubly encapsulated construction;

(2) Contain radioactive material whose chemical and physical forms are as insoluble and non-dispersible as practical; and,

(3) Has been individually pressure tested to at least 24,656 pounds per square inch absolute (170 MN/m^2) without failure.

(B) For sealed sources, except those containing radioactive material in gaseous form, acquired after the July 14, 1989, in the absence of a certificate from a transferor certifying that an individual sealed source meets the requirements of 105 CMR 120.918(A), the sealed source shall not be put into use until such determinations and testing have been performed.

(C) Each sealed source, except those containing radioactive material in gaseous form, used in downhole operations after the effective date of 105 CMR 120.000, shall be certified by the manufacturer, or other testing organization acceptable to the Agency, as meeting the sealed source performance requirements for oil well-logging as contained in the American National Standard N43.6, *Classification of Sealed Radioactive Sources*, (formerly N543, ANSI/NBS 126) in effect on the effective date of 105 CMR 120.900.

(D) Certification documents shall be maintained for inspection by the Agency for a period of three years after source disposal. If the source is abandoned downhole, the certification documents shall be maintained until the Agency authorizes disposition.

120.919: Labeling

(A) Each source, source holder, or logging tool containing radioactive material shall bear a durable, legible, and clearly visible marking or label, which has, as a minimum, the standard radiation caution symbol, without the conventional color requirement, and the following wording:

DANGER [OR CAUTION]
RADIOACTIVE

This labeling shall be on the smallest component transported as a separate piece of equipment.

(B) Each transport container shall have permanently attached to it a durable, legible, and clearly visible label which has, as a minimum, the standard radiation caution symbol and the following wording:

120.919: continued

DANGER [OR CAUTION]
RADIOACTIVE
NOTIFY CIVIL AUTHORITIES [OR NAME OF COMPANY]

120.920: Inspection and Maintenance

(A) Each licensee shall visually check source holders, logging tools, and source handling tools, for defects before each use to ensure that the equipment is in good working condition and that required labeling is present. If defects are found, the equipment must be removed from service until repaired, and a record must be made listing: the equipment involved, defects found, and retained for three years after the defect is found.

(B) Each licensee or registrant shall conduct, at intervals not to exceed six months, a program of inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools to assure proper labeling and physical condition. Records of inspection and maintenance shall be maintained for a period of three years for inspection by the Agency.

(C) If any inspection conducted pursuant to 105 CMR 120.920(A) reveals damage to labeling or components critical to radiation safety, the device shall be removed from service until repairs have been made.

(D) The repair, opening, or modification of any sealed source shall be performed only by persons specifically authorized to do so by the Agency, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State.

(E) If a sealed source is struck in the source holder, the licensee shall not perform any operation, such as drilling, cutting, or chiselling, on the source holder unless the licensee is specifically approved by the Agency to perform such operation.

120.931: Training Requirements

(A) No licensee or registrant shall permit any individual to act as a logging supervisor as defined in 105 CMR 120.900 until such individual has:

(1) Received, in a course recognized by the Agency, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State, instruction in the subjects outlined in 105 CMR 20.960: *Appendix A* and demonstrated an understanding thereof;

(2) Read and received instruction in the regulations contained in 105 CMR 120.900 and the applicable sections of 105 CMR 120.001, 120.200 and 120.750 or their equivalent, conditions of appropriate license or certificate of registration, and the licensee's or registrant's operating and emergency procedures, and demonstrated an understanding thereof; and,

(3) Demonstrated competence to use sources of radiation, related handling tools, and radiation survey instruments which will be used on the job.

(B) No licensee or registrant shall permit any individual to assist in the handling of sources of radiation until such individual has:

(1) Read or received instruction in the licensee's or registrant's operating and emergency procedures and demonstrated an understanding thereof;

(2) Demonstrated competence to use, under the personal supervision of the logging supervisor, the sources of radiation, related handling tools, and radiation survey instruments which will be used on the job; and,

(3) Has received instruction in applicable sections of 105 CMR 120.200 and 120.750.

(C) The licensee or registrant shall maintain employee training records for inspection by the Agency for three years following termination of employment.

(D) The licensee or registrant shall provide safety reviews for logging supervisors and logging assistants at least once during each calendar year.

120.932: Operating and Emergency Procedures

The licensee's or registrant's operating and emergency procedures shall include instructions in at least the following:

(A) Handling and use of sources of radiation to be employed, including the use of sealed sources in wells without surface casing for protecting fresh water aquifers if appropriate, so that no individual is likely to be exposed to radiation doses in excess of the standards established in 105 CMR 120.200;

(B) Methods and occasions for conducting radiation surveys;

(C) Methods and occasions for locking and securing sources of radiation;

(D) Personnel monitoring and the use of personnel monitoring equipment;

(E) Transportation to temporary jobsites and field stations, including the packaging and placing of sources of radiation in vehicles, placarding of vehicles, and securing sources of radiation during transportation;

(F) Minimizing exposure of individuals in the event of an accident;

(G) Procedure for notifying proper personnel in the event of an accident;

(H) Maintenance of records;

(I) Inspection and maintenance of source holders, logging tools, source handling tools, storage containers, transport containers, and injection tools;

(J) Procedure to be followed in the event a sealed source is lodged downhole; and,

(K) Procedures to be used for picking up, receiving, and opening packages containing radioactive material.

(L) For the use of tracers, decontamination of the environment, equipment, and personnel;

(M) Maintenance of records by temporary personnel at temporary jobsites;

(N) Actions to be taken if a sealed source is ruptured, including actions to prevent the spread of contamination and minimize inhalation and ingestion of radioactive material and actions to obtain suitable radiation survey instruments as required by 105 CMR 120.903; and,

(O) The use of remote handling tools for handling sealed sources and radioactive tracer material except low-activity calibration sources.

120.933: Personnel Monitoring

(A) No licensee or registrant shall permit any individual to act as a logging supervisor or to assist in the handling of sources of radiation unless each such individual wears either a film badge or a thermoluminescent dosimeter (TLD). Each film badge or TLD shall be assigned to and worn by only one individual. Film badges must be replaced monthly and TLD badges replaced at least quarterly. After replacement, each film badge or TLD must be promptly processed.

(B) Personnel monitoring records shall be maintained for inspection until the Agency authorizes disposition.

120.941: Security

(A) A logging supervisor must be physically present at a temporary jobsite whenever licensed material are being handled or are not stored and locked in a vehicle or storage place. The logging supervisor may leave the jobsite in order to obtain assistance if a source becomes lodged in the well.

(B) During each logging or tracer application, the logging supervisor or other designated employee shall maintain direct surveillance of the operation to protect against unauthorized and/or unnecessary entry into a restricted area, as defined in 105 CMR 120.005.

120.942: Handling Tools

The licensee shall provide and require the use of tools that will assure remote handling of sealed sources other than low activity calibration sources.

120.943: Subsurface Tracer Studies

(A) Protective gloves and other appropriate protective clothing and equipment shall be used by all personnel handling radioactive tracer material. Precautions shall be taken to avoid ingestion or inhalation of radioactive material.

(B) No licensee shall cause the injection of radioactive material into potable aquifers without prior written authorization from the Agency.

120.944: Particle Accelerators

No licensee or registrant shall permit above-ground testing of particle accelerators, designed for use in well logging, which results in the production of radiation, except in areas or facilities controlled or shielded so that the requirements of 105 CMR 120.200, as applicable, are met.

120.945: Uranium Sinker Bars

The licensee may use a uranium sinker bar in well logging after the effective date of 105 CMR 120.000 only if it is legibly impressed with the words "CAUTION -- RADIOACTIVE -- DEPLETED URANIUM" and "NOTIFY CIVIL AUTHORITIES (or COMPANY NAME) IF FOUND."

120.946: Use of a Sealed Source in a Well Without a Surface Casing

The license may use a sealed source in a well without casing for protecting fresh water aquifers only if the licensee follows a procedure for reducing the probability of the source becoming lodged in the well. The procedure must be approved by the Agency.

120.951: Radiation Surveys

(A) Radiation surveys and/or calculations shall be made and recorded for each area where radioactive materials are used and stored.

(B) Radiation surveys and/or calculations shall be made and recorded for the radiation levels in occupied positions and on the exterior of each vehicle used to transport radioactive material. Such surveys and/or calculations shall include each source of radiation or combination of sources to be transported in the vehicle.

(C) After removal of the sealed source from the logging tool and before departing the jobsite, the logging tool detector shall be energized, or a survey meter used, to assure that the logging tool is free of contamination.

(D) Radiation surveys shall be made and recorded at the jobsite or wellhead for each tracer operation, except those using hydrogen-3, carbon-14, and sulfur-35. These surveys shall include measurements of radiation levels before and after the operation.

120.951: continued

(E) Records required pursuant to 105 CMR 120.951(A) through (D) shall include the dates, the identification of individual(s) making the survey, the identification of survey instrument(s) used, and an exact description of the location of the survey. Records of these surveys shall be maintained for inspection by the Agency for three years after completion of the survey.

120.952: Documents and Records Required at Field Stations

Each licensee or registrant shall maintain, for inspection by the Agency, the following documents and records for the specific devices and sources used at the field station:

(A) Appropriate license, certificate of registration, or equivalent document;

(B) Operating and emergency procedures;

(C) Applicable regulations;

(D) Records of the latest survey instrument calibrations pursuant to 105 CMR 120.914;

(E) Records of the latest leak test results pursuant to 105 CMR 120.915;

(F) Quarterly inventories required pursuant to 105 CMR 120.916;

(G) Utilization records required pursuant to 105 CMR 120.917;

(H) Records of inspection and maintenance required pursuant to 105 CMR 120.920;

(I) Survey records required pursuant to 105 CMR 120.951; and,

(J) Training records required pursuant to 105 CMR 120.931.

120.953: Documents and Records Required at Temporary Jobsites

Each licensee or registrant conducting operations at a temporary jobsite shall have the following documents and records available at that site for inspection by the Agency:

(A) Operating and emergency procedures;

(B) Survey records required pursuant to 105 CMR 120.951 for the period of operation at the site;

(C) Evidence of current calibration for the radiation survey instruments in use at the site;

(D) When operating in the Commonwealth under reciprocity, a copy of the appropriate license, certificate of registration, or equivalent document(s); and,

(E) Shipping papers for transportation of radioactive material.

120.954: Notification of Incidents, Abandonment, and Lost Sources

(A) Notification of incidents and sources lost in other than downhole logging operations shall be made in accordance with provisions of 105 CMR 120.281 and 120.282 and 120.142.

(B) Whenever a sealed source or device containing radioactive material is lodged downhole, the licensee shall:

(1) Monitor at the surface for the presence of radioactive contamination with a radiation survey instrument or logging tool during logging tool recovery operations; and,

120.954: continued

(2) Notify the Agency immediately by telephone and subsequently, within 30 days, by confirmatory letter if the licensee knows or has reason to believe that a sealed source has been ruptured. This letter shall identify the well or other location, describe the magnitude and extent of the escape of radioactive material, assess the consequences of the rupture, and explain efforts planned or being taken to mitigate these consequences.

(C) When it becomes apparent that efforts to recover the radioactive source will not be successful, the licensee shall:

(1) Advise the well-operator of an appropriate method of abandonment, which shall include:

(a) The immobilization and sealing in place of the radioactive source with a cement plug;

(b) The setting of a whipstock or other deflection device; and,

(c) The mounting of a permanent identification plaque, at the surface of the well, containing the appropriate information required by 105 CMR 120.954(D);

(2) Notify the Agency by telephone, giving the circumstances of the loss, and request approval of the proposed abandonment procedures; and,

(3) File a written report with the Agency within 30 days of the abandonment, setting forth the following information:

(a) Date of occurrence and a brief description of attempts to recover the source;

(b) A description of the radioactive source involved, including radionuclide, quantity, and chemical and physical form;

(c) Surface location and identification of well;

(d) Results of efforts to immobilize and set the source in place;

(e) Depth of the radioactive source;

(f) Depth of the top of the cement plug;

(g) Depth of the well; and,

(h) Information contained on the permanent identification plaque.

(D) Whenever a sealed source containing radioactive material is abandoned downhole, the licensee shall provide a permanent plaque for posting the well or well-bore (an example of a suggested plaque is shown in 105 CMR 120.900: *Appendix* 120.770-B). This plaque shall:

(1) Be constructed of long-lasting material, such as stainless steel or monel; and,

(2) Contain the following information engraved on its face:

(a) The word "CAUTION";

(b) The radiation symbol without the conventional color requirement;

(c) The date of abandonment;

(d) The name of the well operator or well owner;

(e) The well name and well identification number(s) or other designation;

(f) The sealed source(s) by radionuclide and quantity of activity;

(g) The source depth and the depth to the top of the plug; and,

(h) An appropriate warning, depending on the specific circumstances of each abandonment. [Appropriate warnings may include: (A) "Do not drill below plug back depth"; (B) "Do not enlarge casing"; or (C) "Do not re-enter the hole", followed by the words, "before contacting the Massachusetts Radiation Control Program".]

(E) The licensee shall immediately notify the Agency by telephone and subsequently by confirming letter if the licensee knows or has reason to believe that radioactive material has been lost in or to an underground potable aquifer. Such notice shall designate the well location, describe the magnitude and extent of loss of radioactive material, the consequences of such loss, and explain efforts planned or being taken to mitigate these consequences.

120.960: Appendix A -- Subjects to be Included in Training Courses for Logging Supervisors

I. Fundamentals of Radiation Safety
- A. Characteristics of radiation
- B. Units of radiation dose and quantity of radioactivity
- C. Significance of radiation dose
  1. Radiation protection standards
  2. Biological effects of radiation dose
- D. Levels of radiation from sources of radiation
- E. Methods of minimizing radiation dose
  1. Working time
  2. Working distances
  3. Shielding
- F. Radiation safety practices including prevention of contamination and methods of decontamination.

II. Radiation Detection Instrumentation to be Used
- A. Use of radiation survey instruments
  1. Operation
  2. Calibration
  3. Limitations
- B. Survey techniques
- C. Use of personnel monitoring equipment

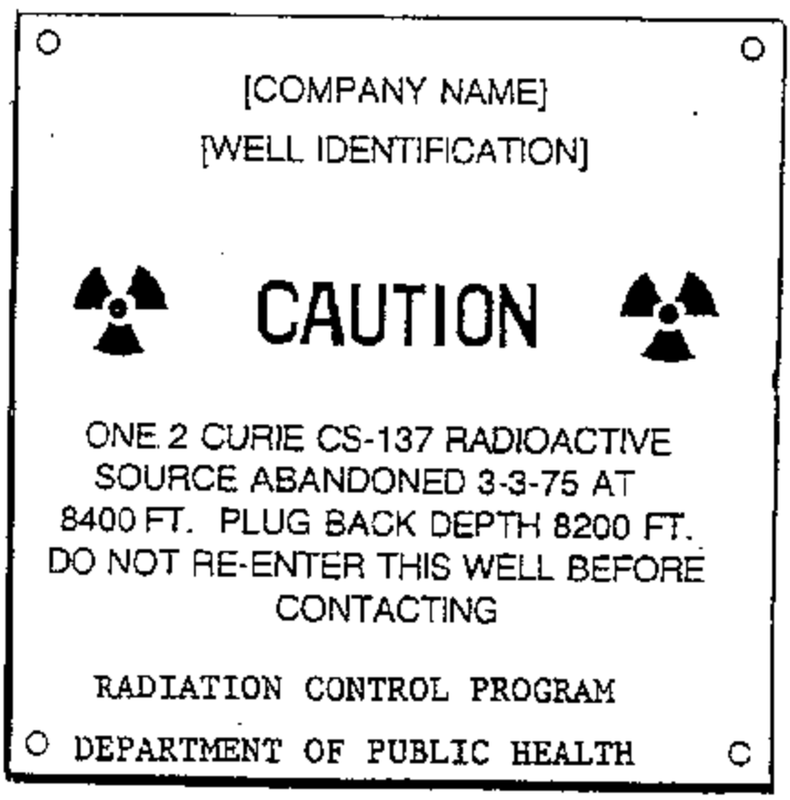
III. Equipment to be Used
- A. Handling equipment
- B. Sources of radiation
- C. Storage and control of equipment
- D. Operation and control of equipment

IV. The Requirements of Pertinent Federal and Commonwealth Regulations

V. The Licensee's or Registrant's Written Operating and Emergency Procedures

VI. The Licensee's or Registrant's Record Keeping Procedures

120.961: Appendix A -- Example of Plaque for Identifying Wells Containing Sealed Sources Containing Radioactive Material Abandoned Downhole



The size of the plaque should be convenient for use on active or inactive wells, *e.g.*, a seven-inch square. Letter size of the word "CAUTION" should be approximately twice the letter size of the rest of the information, *e.g.*, ½-inch and ¼-inch letter size, respectively.

REGULATORY AUTHORITY

105 CMR 120.000: M.G.L. c. 111, §§ 3, 5, 5M, 5N, 5O and 5P.